Contrast enhancement of eye fundus images

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Background

A significant number of digital eye fundus images have strong contrast variations which can be a limiting factor for the diagnosis of the diabetic retinopathy lesions.

Current solution: manual contrast made by graders.

Limitations:
- This is not easily reproducible.
- Images may still be considered un-gradable because they are too bright or too dark.

Causes: Cataract, motion of the patient, acquisition conditions and differences in absorptions of the light in the eye.

Aim

We have developed a fully automatic method, which achieves contrast uniformity across the entire image.

Method

It is based on a colour model consistent with the physical principles of image formation.

The contrast of the dark or the bright elements are adjusted in a way that provides a similar colour aspect to lesions such as micro-aneurysms or to anatomical structures such as veins.

It is much more powerful than the previous existing grey level methods using polynomial adjustment (1), mathematical morphology (2) or histogram equalisations (3).

Results

It has been tested on more than 2000 images acquired from different screening services ranging from a high resource country with quality controlled process while others were obtained from low resource countries under harsher conditions.

Some images were bright while others were dark making diagnosis difficult.

For all images, the lighting variations have been corrected and the contrast has been enhanced for lesions such as micro-aneurysms and the vascular structures.

=> Easier detection by graders.

Discussion

This new colour contrast method is very promising tool to assist graders in diagnosing the presence of diabetic retinopathy and other lesions present in digital eye fundus images since the lesions appear to be much more evident in comparison of the original image.

Importantly our method is fully automatic and can be easily integrated in a screening system.

Figure 1. Contrast enhancement by our colour method using images from a high-resource country.

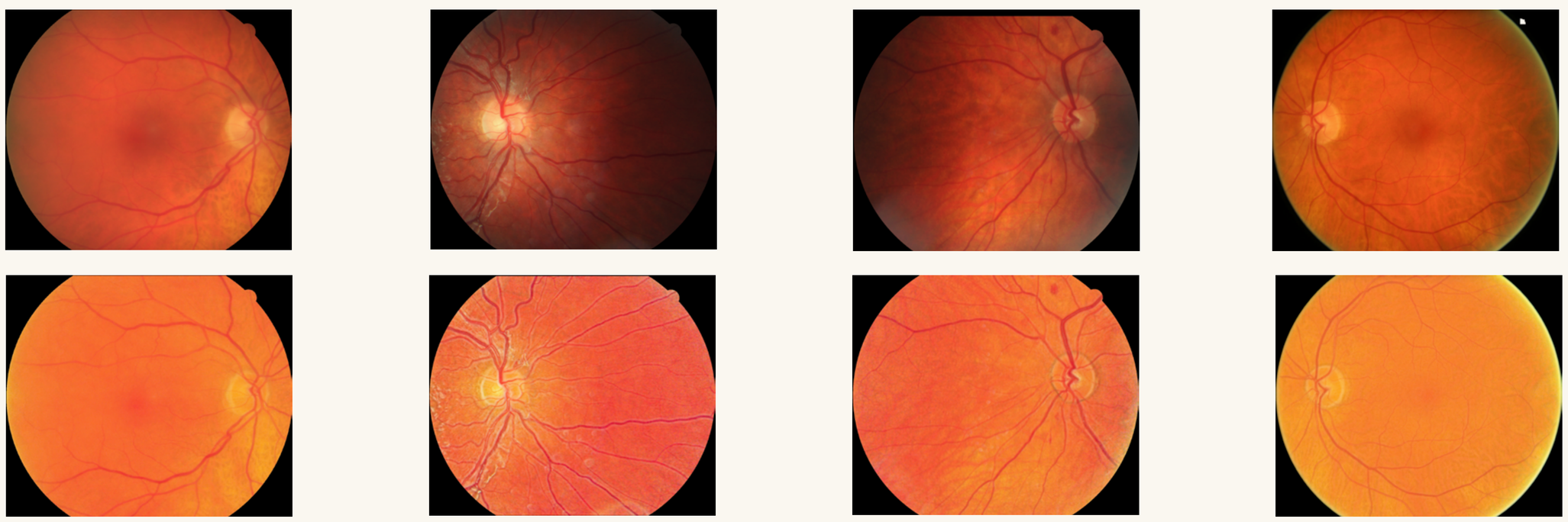
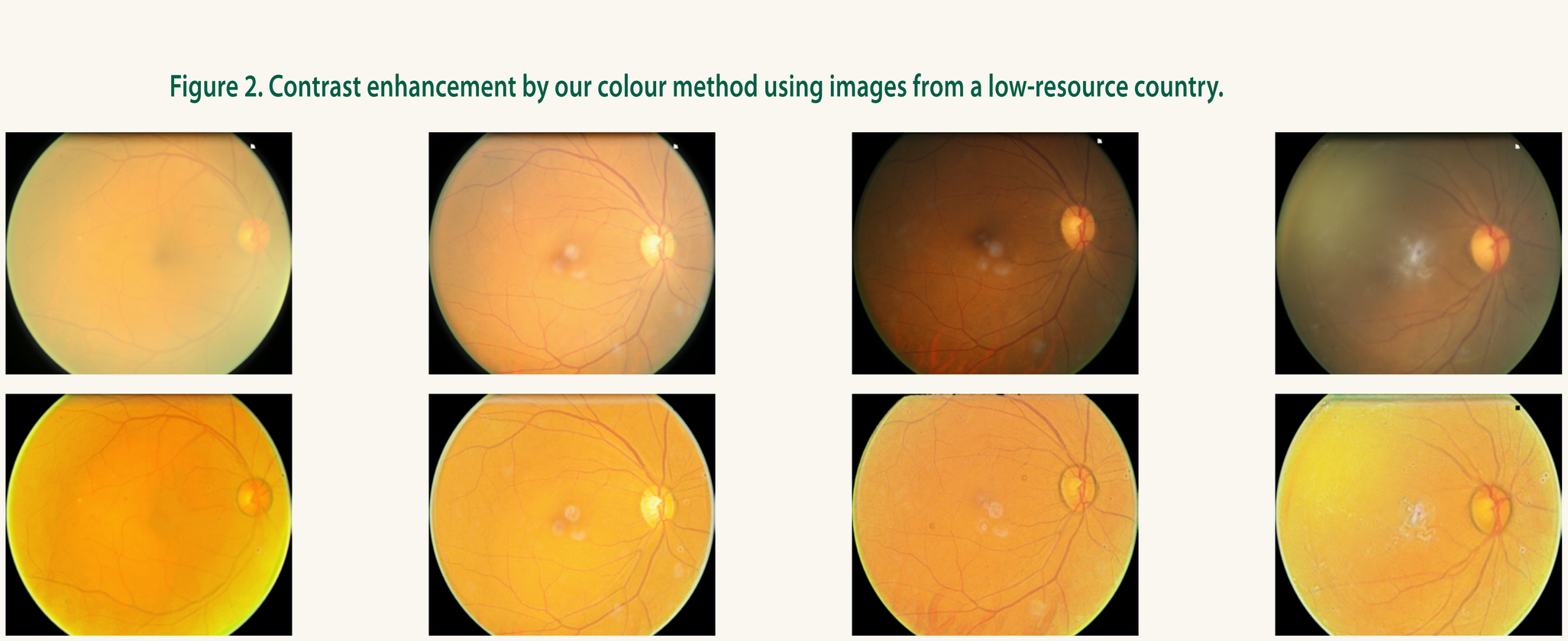


Figure 2. Contrast enhancement by our colour method using images from a low-resource country.



Conflict of interest disclosure:
This poster does not contain any trade names. This poster does not cover any unapproved uses of specific drugs, other products or devices.

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"Prevention is better than healing because it saves the labour of being sick." Thomas Adams, 1680

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